

## VETERANS COME HOME

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On September 2, 1945, for the first time in more than a decade the nations of the world were at peace. Now begins the slow process of demobilization and the still slower readjustment to peaceful pursuits. The veteran comes home. To what does he return? How does the world of today compare with that when Japan invaded Manchuria? In many ways it is a changed world to all of us:

Our economic status has changed. Much of the world is impoverished to the point of destitution. Even in this country, much more fortunate than most, the dollar has a decreased purchasing power. There is a huge national debt. Taxes are at an all-time high.

Our natural resources have been seriously depleted. Scientific discoveries and engineering applications will have to be depended upon to make up for many of these losses.

Social concepts and usages have changed, some of them in directions that would have been labeled "socialistic" not many years ago. Individual incomes have been leveled off—very large ones are no longer possible; great estates may no longer pass from generation to generation; earnings of many skilled workmen have passed those of the "white collar" group, including especially school teachers, ministers, and many members of college faculties.

Evidences of class consciousness begin to appear and at the moment there are indications of serious industrial disputes and labor troubles.

Our educational system remains substantially unchanged amid changed condition around it, except for depletion of faculties and serious financial losses.

For the past four years there has been almost a complete cessation of the production of young men and women for service in science and technology, and this condition threatens to continue for two or three years longer. This "lost generation" of engineers and scientists is one of the most harmful of all the effects of the war. Unfortunately, the return of the veteran to academic training cannot remedy it promptly enough.

In many ways, however, and in spite of some of the conditions just recited, our nation has achieved a new and better social consciousness.

We have a vastly expanded industrial system capable of producing almost everything in sufficient quantity to supply the needs of the whole world if only it is administered wisely, our economic system remains sound, and methods of distribution can be worked out as adequate as those of production.

We have at our command many new and very significant developments of science and engineering that, if properly developed and directed to useful purposes, may go a long way toward repairing the economic and physical losses produced by the war.

And, of greatest significance, we have at hand the fundamental method of approach to still further and more valuable achievements in science and engineering for use in the interests of mankind.

On the whole, then, in spite of calamities of the past and difficulties of the present, the future holds great promise for us if we can only deal wisely with human frailties and marshal our resources for the common good. To so much in his favor, the veteran returns.

He returns also to a nation that appreciates fully what he has done to defend it and that is ready to translate its appreciation into tangible form worth far more to him than the bonus after World War I. Among these benefits and of chief immediate significance to us in the colleges is the opportunity, by means of Federal support, to complete his education. How well, we ought to ask ourselves, is our part of the educational system likely to fit his needs? Is it adapted as well as it should be to the altered world we face? Many people, in all branches of education including engineering, are considering this problem with a great deal of seriousness. Education is proverbially slow to adapt itself to changing conditions; and perhaps it is well, generally speaking, that it is, lest it go off on tangents or into blind alleys. But the past few years have been revolutionary in a good many ways, and especially in science and engineering. What are some of these changes? How may engineering education serve them without sacrificing its fundamental merits? This broad problem is too extensive for discussion in all its aspects here, but there are one or two to which attention may be directed.

Two great changes, or perhaps it would be more accurate to say accelerations of trends, have become clearly apparent during the war:

One of these is the tremendous increase of scientific discoveries and their application. New devices involving scientific principles and engineering applications have produced results of a type undreamed of a few years ago. Work at the upper levels of scientific principles has come to need a type of training far beyond the conventional four-year curriculum. As a result, a good many scientists, especially physicists and chem-

ists, have been doing development work that would ordinarily be called engineering. This is said on the testimony of directors, including engineers, of research laboratories and production industries.

Another trend is the vastly increased use of scientific principles and engineering methods in manufacturing processes. Plants making one type of product have been converted almost over night to something quite different and have turned it out in tremendous quantities. Technical developments of a very high order have been required in devising and perfecting the process of making such new products, developments quite as difficult to plan and fully as technical in their operation as those involved in designing the product itself. The adaptation of rational design to production methods as well as to functional usage is, in fact, one of the great achievements of the war. On it, to a major extent, has depended the outcome of the war. It is perfectly plain that in future this phase of industrial need must be met in engineering education in the same way that the needs of product design have been met.

It seems clear, therefore, that the programs of engineering education must be adapted to the satisfaction of three basic requirements, all at college level:

(1) The training of a large group of men qualified to fill the bulk of positions at the middle levels of engineering responsibilities in design and construction, for which the traditional type of four-year undergraduate curriculum has in the past been found on the whole to be adequate.

(2) The training of a group prepared, as well as is possible in a college environment, to enter the production side of industry, for which our present type of curriculum seems not to be as well adapted as it might be. In our own institution, the curriculum in industrial engineering is well situated to this need. But we are one of comparatively few institutions that offer such a curriculum on a genuine engineering foundation. Furthermore, there appears to be need for a fairly large fraction of other engineering students, such as mechanical and electrical engineers, to substitute some courses in principles and methods of production for courses preparatory to design work.

(3) There is need for another and perhaps somewhat smaller group, yet of significant numbers and certainly much more numerous than in the past, who are well equipped both in basic science and the techniques of its advanced applications to enter the higher realms of creative achievement.

Thus it seems that our engineering schools must fulfill a three-fold purpose involving the training of men for functions that may be called,

respectively: design and construction; production; and research and development. Can this be done without sacrificing the great assets of thoroughness, accuracy, knowledge of fundamentals, and introduction to the arts of practice that engineering education has possessed in the past? Can it be accomplished through a substantially common type of program?

A good many engineering educators are beginning to feel that some important modifications of curricula are needed to adapt them to these changed requirements. What form may such modifications take? One suggestion is that a common program in a given branch, such as mechanical engineering, be provided for the first three years, devoted chiefly to basic science and technology, but providing some basis for an understanding of social and economic problems of concern to engineers, and followed by a fourth year of differentiation into three branches, respectively; a terminal technological program; a program terminal for some but leading to more advanced work for others in the production aspects of industry; and a program (with some courses in common with students from other branches) more strictly preparatory in content and method of work—especially the latter—to more advanced scientific and technological work of additional years leading to advanced degrees.

Is such a proposal feasible of accomplishment? Will students divide themselves or can they be divided among the three divisions in accord with their qualifications and needs? These are very important questions. Great care will be required to answer them correctly, and they *must* be answered correctly lest harm be done to a system of education that has proved itself sound and adequate to meet many industrial and professional needs.

A good many people are addressing themselves to the devising of programs designed to solve this problem. One solution that is being proposed, and in a few instances adopted, is lengthening the curriculum to five years, thus continuing the common program for all by combining elements of general education, science, technology, and production practice into a required program regardless of the needs and capacities of students or the requirements of occupations they are to follow. In common with many others, I doubt whether this is the best solution, all factors considered.

Others are considering the feasibility of differentiating programs in the fourth and subsequent years as above outlined. This, it seems to me, is a line of exploration that should be followed. Let us hope that it may be studied and a solution found in time to adapt it to the needs of the great influx of students that is now beginning, including the veterans we are welcoming back to our campus.